Institute for Industry-Education Collaboration
McNEESE STATE UNIVERSITY

Henry Kister: Practical Distillation Technology

McNeese Institute for Industry-Education Collaboration | November 9-12, 2026

Program Overview

The program contains a core section from Tuesday, November 10 through Thursday, November 12 (ending at noon). To support participants from both the petroleum refining and chemical industries, two optional workshops are included:

Chemical Distillation Workshop: Monday afternoon, November 9

Refinery Distillation Workshop: Thursday afternoon, November 12

Participants are invited to attend the core program plus one or both workshops. All sessions are included in the course fee - no additional cost for attending both workshops.

CORE Day 1 - Tuesday, November 10, 8 AM - 5 PM

LESSONS FROM 50 YEARS OF TOWER MALFUNCTIONS

- What malfunctions should troubleshooters look for? Do the malfunctions repeat themselves?
- The top 10 malfunctions experienced in distillation towers: plugging/coking, tower base, internals damage, startup/shutdown mishaps, installation mishaps, packing distributors, intermediate draws, misleading instrumentation, reboilers, controls. How can these malfunctions be alleviated?
- Water in hot oil fractionators: the #1 cause of trays/packing damage.
- Submerging feed and reboiler return inlets: how it induces premature floods, tray/packing damage or even overfills.
- The plugging challenge: can it be alleviated?

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TRAY HYDRAULICS & LIMITS

- Visualization of flooding, entrainment, foaming, weeping, dumping, vapor-liquid dispersions on trays.
- Flood mechanisms: jet (entrainment), system limit, downcomer backup, downcomer choke: which one is likely to limit your column capacity? Do simulations contain trustworthy flood predictions?
- C-factors and operating envelopes: are they useful for operation?
- Common tray types: sieve, moving valve, fixed valve, shed decks: pros and cons. Which works well in fouling services?
- Small holes, valves: benefits and traps.
- Hole area: can too much lead to troubleshooting assignments?
- Tray efficiency: are simulation predictions reliable? Can it be enhanced by tray modification?

TROUBLESHOOTING TRAY TOWERS

- Flooding symptoms: high dP's, reduced bottoms, others. Which can be trusted?
- Liquid and vapor-sensitivity field tests: identifying the likely flood mechanism.
- dP plots: getting the most out of your plant data to diagnose floods.
- Dealing with foams in chemical and refinery services: diagnosis, testing, and alleviating.
- Downcomer unsealing and tray dryout: why many crude and FCC fractionators require excess wash and how to reduce.
- Tray channeling: efficiency and capacity loss in chemical towers.
- Gamma scans: application for detecting flooding, missing and damaged trays, foaming, and downcomer flooding.
- How to combine gamma scans with process checks to get the most out of the scans and avoid misinterpretation: the four keys to success.

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CORE Day 2 - Wednesday, November 11, 8 AM - 5 PM

TROUBLESHOOTING TRAY TOWERS (CONT'D)

TROUBLESHOOTING PACKED TOWERS

- Visualization of normal and flooded packing operation.
- Rules of thumb for flood pressure drop and packing efficiency.
- Simulation hydraulic calculation: to trust or not to trust?
- Grid gamma scanning for detecting maldistribution, damage, distributor malfunction, distributor and collector overflows.
- Distributor, collector, and parting box overflows: DEATH for packed beds. How to diagnose and how to avoid.
- Can poor distributor feeding bottleneck towers?
- Temperature surveys: application for simulation and maldistribution checks. How to conduct, what to avoid. The secrets they reveal.
- Neutron backscatter and CAT scans: what can they reveal that regular gamma scans cannot.

TOWER DEBOTTLENECKS

- Factors that favor trays and factors that favor packings.
- The pressure drop bonanza: why packings win in vacuum towers, in compressor suction, and in the path of a fan.
- Should packings be used in fouling services, or are trays better?
- Pitfalls unique to structured packings: high pressure application, oxidation, shutdown fires.
- High-capacity trays (e.g. Superfrac®, VG Plus®, Hi- Fi®, MD®): principles, tricks and traps. Do they really give 30% more capacity?
- Avoiding costly or failed revamps due to misdiagnosis

DISTILLATION CONTROL (START, CONT'D DAY 3)

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CORE Day 3 - Thursday, November 12, 8 AM - 12:15

DISTILLATION CONTROL

- Assembling control loops into an overall scheme: what works, what causes instability, and what impairs efficiency.
- The 3 most common causes of control assembly failure: no material balance control, fighting between temperature controllers, and level control on a small stream.
- The No. 1 control problem in refineries: is your fractionator immune?
- Finding the best temperature control location: how reliable?
- Challenging controls: side draw, azeotropic, and extractive distillation.
- Reboiler, condenser and pressure controls: which loops work and which misbehave.
- How dead pockets in vapor overhead lines interfere with controls.
- Flooded condenser controls: what are their pitfalls.
- Understanding hot vapor bypasses: why some work while others don't.
- Can controlling the coolant be troublesome?
- Control systems that did not work.

IDENTIFYING AND REMOVING POTENTIAL MALFUNCTIONS

- This elaborates on the lessons learnt in the malfunctions survey (Core Day 1).
- Points of transition (feeds, side draws, tower base): why these are some of the most severe tower bottlenecks.
- Drawing sketches (to scale) to troubleshoot these internals: you need a sketch, not an expert.
- High tower base levels: how they induce premature flood, tray/packing damage, tower overfills, and how to prevent.
- Common tower base instrument problems: what to watch out for.
- Examining operation charts: what happened first?

- Tray/packing damage: pressure surges due to water entering a tower full of hot oil or insoluble organics, other sources of tray damage and ways to avoid.
- Accumulator trays: do's, don'ts, and how they bottleneck fractionators.
- Common accumulator tray problems: overflow, hydraulic gradients, liquid bypassing.
- Liquid outlets: choking in sidedraw rundown lines and internal piping and how it restricts fractionator capacity.
- Kettle reboilers and once-through thermosiphon reboilers: why are they common causes of bottlenecks.

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Optional Workshops

Chemical Distillation Workshop - Monday, November 9th (afternoon, 1 PM - 5 PM)

AVOIDING FRACTIONATION PITFALLS

- Vapor-liquid equilibrium (VLE): key concepts and simulation traps. Should we believe the simulation?
- Issues with close-boilers and non-idealities: why some heavy components go up while the simulation thinks they go down.
- Henry's Law applications: how liquid non-idealities produce unexpected results.
- Chemical reactions in towers: how to test for.
- VLE data: to trust or not to trust?
- Weaknesses to watch out for in hydrocarbon and chemical VLE predictions
- Multi-component distillation: composition profiles, sidedraws, accumulation, and cycling problems. Things to watch out for.

TROUBLESHOOTING DISTILLATION SIMULATIONS

- Does your simulation reflect the real world? How poor simulation leads to incorrect problem diagnosis.
- What validation checks are needed? How far should we go?
- Temperature profiles: application for simulation validation and for identifying a second liquid phase.
- Sensitivity analysis and graphics for simulation troubleshooting: useful hints.
- Does the simulation provide the correct vapor and liquid loadings for hydraulic evaluation? How to check.

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Refinery Distillation Workshop - Thursday, November 12th (afternoon 1:00 PM - 5 PM)

REFINERY FRACTIONATORS OPTIMIZATION AND OPERATION

- Complex (multi-side-draw) columns: are they simple columns stacked on top of each other?
- Cut points, overlaps, gaps: how they reflect separation quality.
- Functions of the different sections of refinery fractionators: fractionation, pumparound, wash, stripping. Which sections are prone to damage, coking, salting out and which are generally well-behaved.
- Why preflash drums/ towers are used and what are their issues.
- Similarities and differences between atmospheric crude and FCC fractionators.
- To what extent does improving separation enhance yield of a desirable product?
- Changes in cut point: how do they affect a fractionator? Can they lead to flooding or aggravate a condenser limitation?
- Maximizing pumparound (PA) duty: how does it affect the tower and what are the constraints? Should a product be drawn above or below the PA?
- Shifting PA duties: can maximizing PA destabilize a fractionator?
- Some rules of thumb for fractionators: stripping rates, tray efficiencies.

CONCEPTS UNIQUE TO REFINERY VACUUM TOWERS

- Vacuum tower wash zones: the most troublesome zone of refinery fractionators. How much wash keeps packing wet? How poor flash zone simulation can lead to wash zone coking.
- True vs. Measured overflash: what is worthless wash?
- Maximizing gas oil yield. Can tall or efficient wash beds impair capacity or lead to coking?

TROUBLESHOOTING TECHNIQUES UNIQUE TO REFINERY TOWERS

- Mass and heat balance troubleshooting: how these detect insufficient wash, overflows.
- Drawing out heat and mass balance envelopes for multi-draw towers.
- Leak/overflow/excess weep detection: the symptom of low temperature while making more heavy distillate.
- Checking sprays: plugged? broken?
- Simple tests that teach a lot about the nature of the bottleneck.